Mark 5/Mark 6 Comparisons

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TOW meeting
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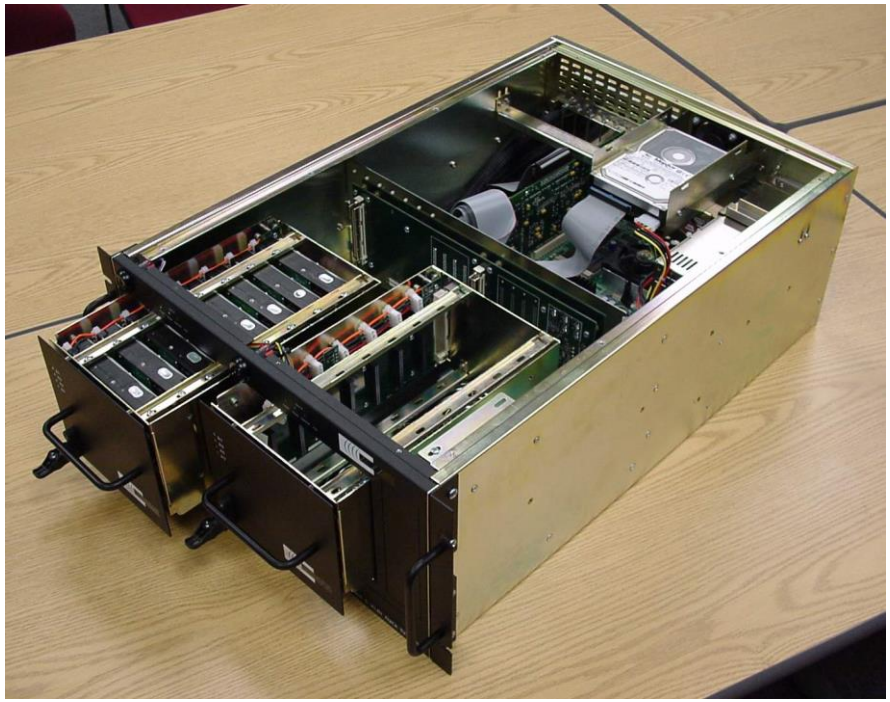
Mark 5 Data Acquisition System

(Mark 5A/B/B+/C all look nearly the same)



	Year introduced	Record rate (Mbps)	Interface	Cost (USk$)	#deployed
Mark 5A	2002	1024	Mk4/VLBA	21	~130
Mark 5B	2005	1024	VSI-H	22	~40
Mark 5B+	2006	2048	VSI-H	23	~30
Mark 5C	2010	4096	10GigE	21	~40

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Mark 5 Basics

- Mark 5 A/B/C all based on standard PC platform with proprietary Conduant-designed 'StreamStor' interface card with proprietary firmware and user-application software library
- Primary Mark 5 targets
  - Mk5A – Mark 3/Mark 4/VLBA tape drive interfaces from data formatters
  - Mk5B – VSI-H compatible formatters of various flavors
  - Mk5C – Ethernet-compatible data formatters of various flavors
- StreamStor interface card allows continuous recording through data-disc failure(s) by re-directing data to only working discs
  (on playback, missing data replaced with specific 'fill-pattern' ignored by correlator)
- Bi-directional user-accessible FPDP data bus on StreamStor card supported user-interface-specific daughterboards for various data interfaces:
  - Mark 5A – VLBA/Mark4 tape-drive interface
  - Mark 5B – VSI-H interface

  (Mark 5C used a standard NIC Ethernet card for input)
- All Mark 5 flavors support either IDE or SATA-tape Mark 5 disk modules

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Mark 5A/B/B+/C System Comparisons

	Mk5A	Mk5B	Mk5B+	Mk5C
Data Interface	Emulates Mk4/VLBA tape transport	VSI-H (32MHz max clock rate)	VSI-H (64MHz max clock rate)	10 Gigabit Ethernet
Max data rate	1024 Mbps	1024 Mbps	2048 Mbps	4096 Mbps
Record modes	8, 16, 32, 64 “tracks”	1,2,4,8,16,32 bitstreams	Same as Mk5B	-
Disks	Mk5 “8-pack”	Same	Same	Same
Chassis	Mk5	Same	Same	Same
I/O card	Mk5A	Mk5B	Mk5B	-
SS card	XF2	XF2	Amazon	Amazon
I/O-SS intf	Modified FPDP	FPDP	FPDP2 (clocks on both edges	-

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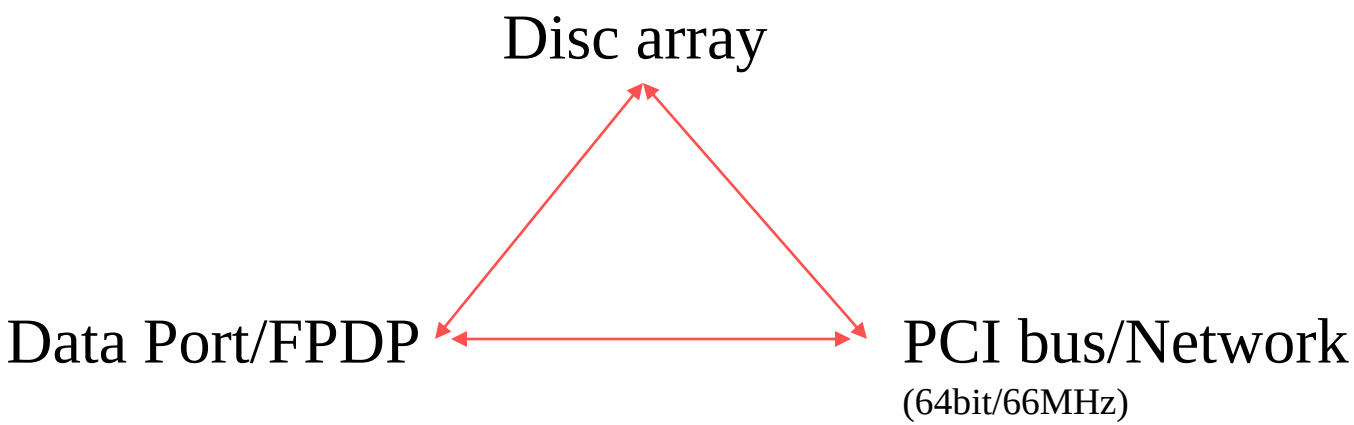
Mark 5 e-VLBI Connectivity

- Mark 5 supports a triangle of connectivity for e-VLBI requirements



Mark 5 can support several possible e-VLBI modes:

- e-VLBI data buffer (first to Disc Array, then to Network); vice versa
- Direct e-VLBI (Data Port directly to Network); vice versa
- Data Port simultaneously to Disc Array and Network at ~800 Mbps

Mark 6 Basics

- Ethernet packet recorder, targeted initially at Mk5B-format-over-Ethernet and VDIF
- Four 10GigE data-input ports
- 16 Gbps aggregate sustained record capability to 32 disks; 32Gbps burst
- Flexible recording modes:
  - Mounted modules may be divided into ‘groups’ that record/playback independently
  - ‘Groups’ may divided into ‘sub-groups’ that record data from specified Ethernet input ports
- Completely-COTS data electronics
  - Upgradeable to follow Moore’s Law progress
- 100% open-source software on Linus O/S
- Resilience to failed disks (on both record and playback)
- Mark 5 SATA-compatible disk modules upgradeable to Mark 6 compatibility
- Relatively inexpensive

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Mark 6 hardware

High-speed data connections to module front-panel via two standard SAS cables

Existing Mark 5 chassis is upgradeable to Mark 6

New chassis backplanes for disk power management

Cable-management panel (unused cables retract into panel)

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Mark 5 SATA Drive Module Upgrade to Mark 6

New Front Panel

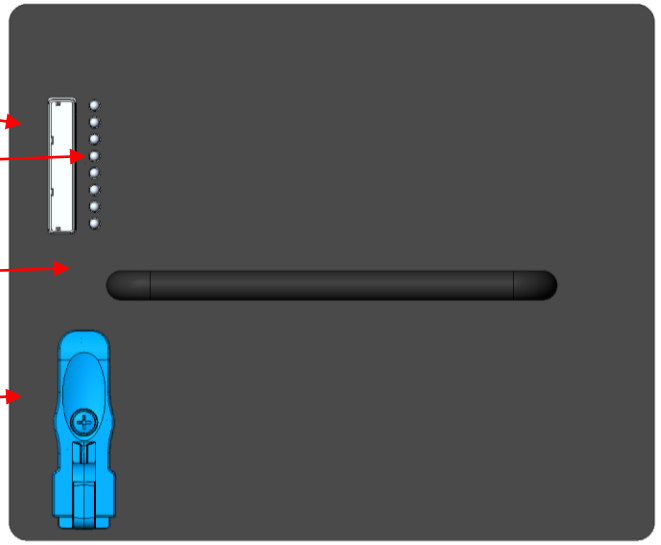
Front Panel

Connectors for two eSATA cables

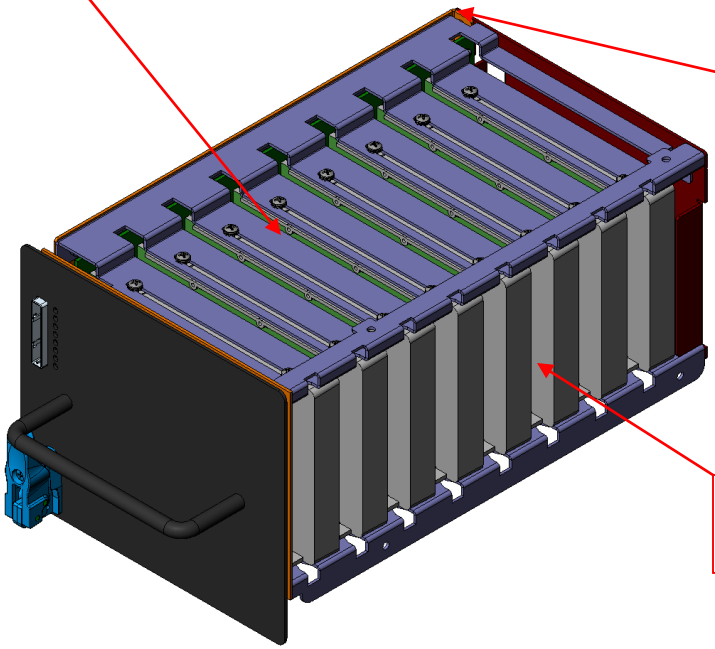
8x LED (1 per drive)

Re-use Handle from old Module

New Latch provided (pre-installed on new Panel)

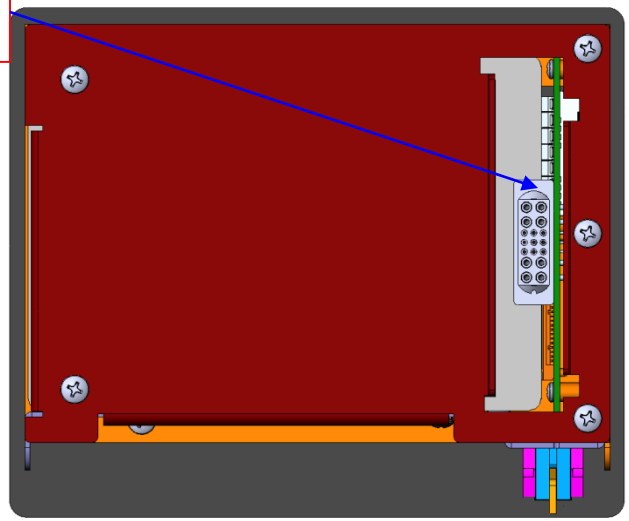


Cooling slots



New PCB and power connector

Rear Panel



Easily removable disks

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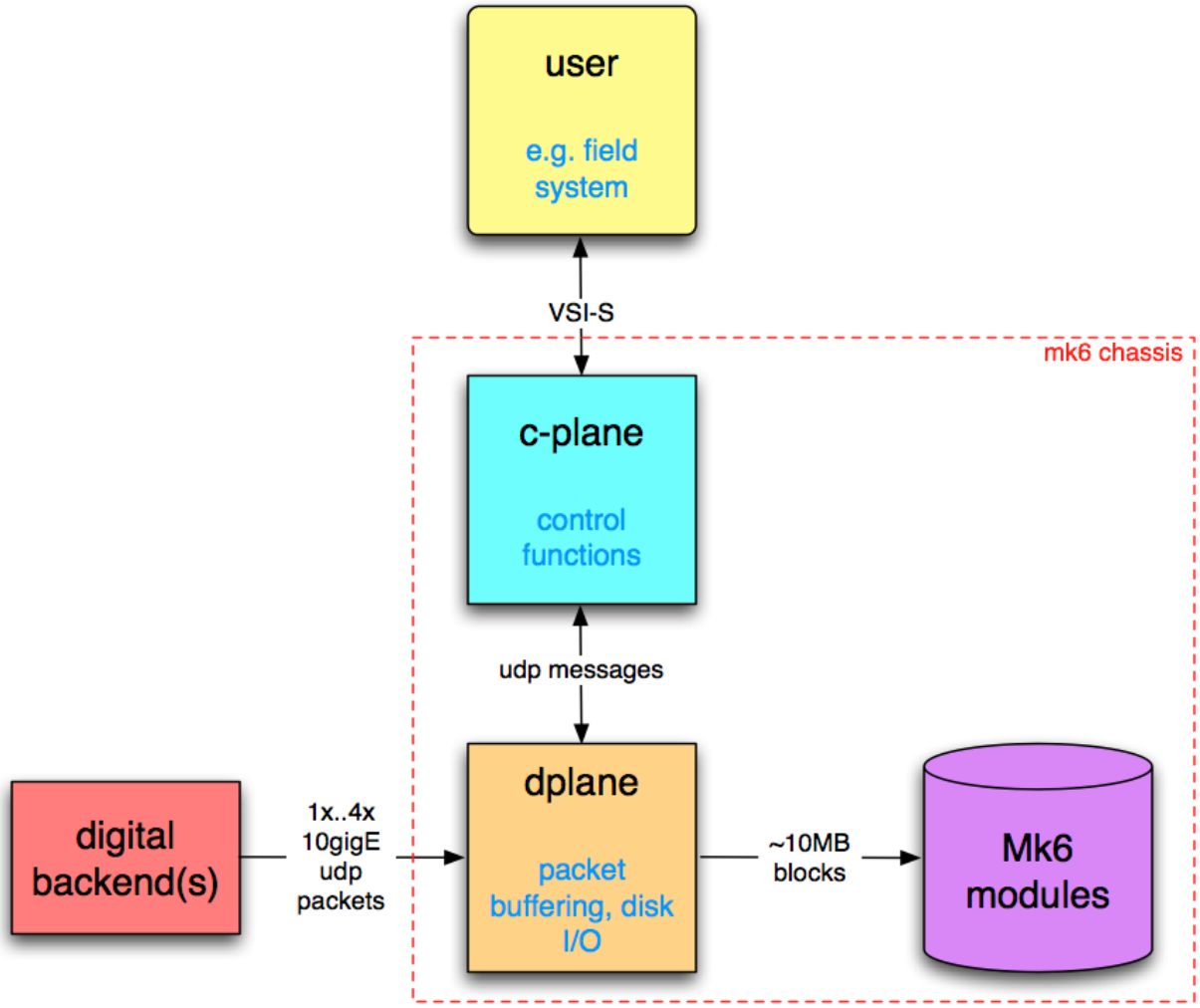
Mark6 software block diagram



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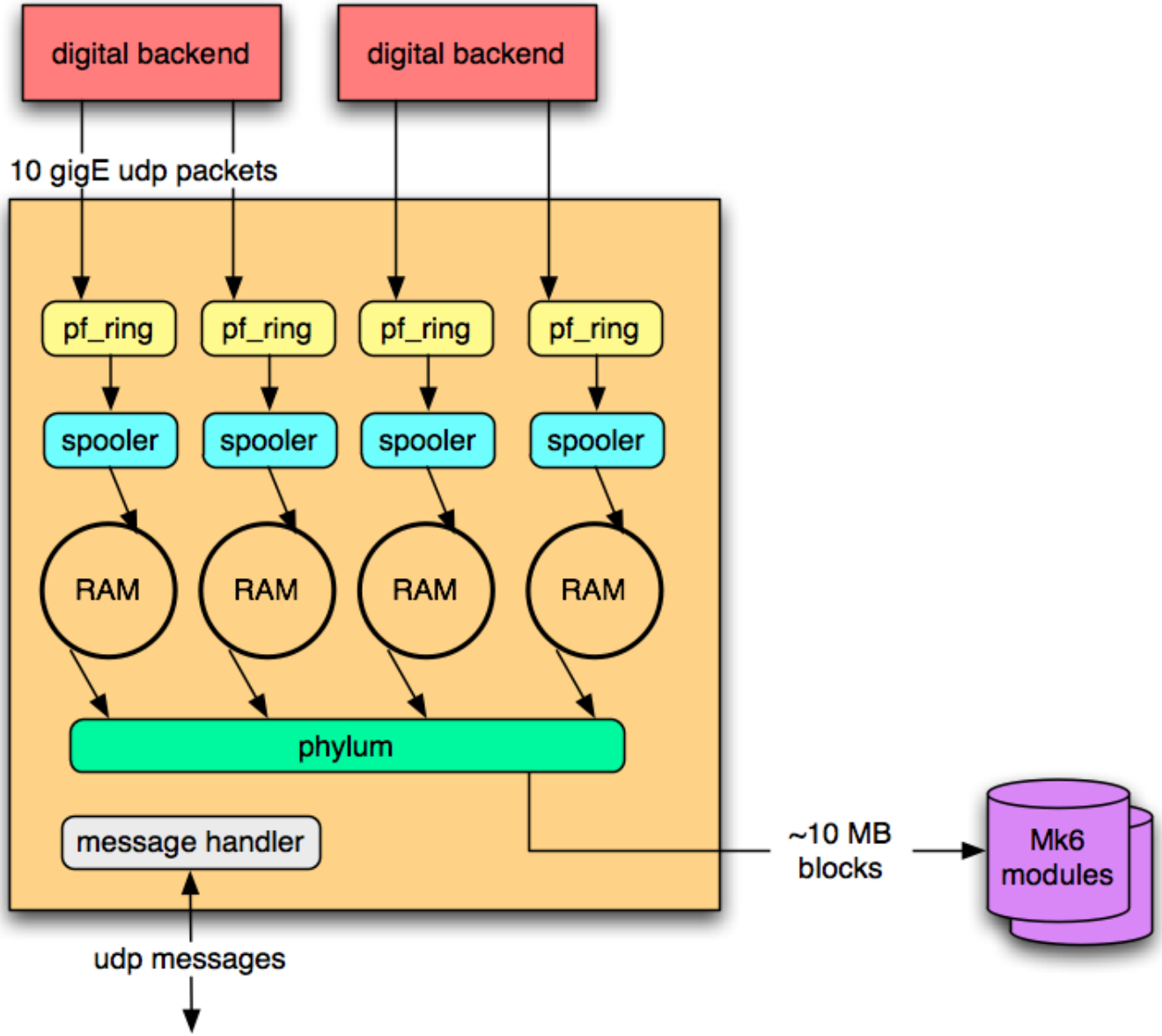

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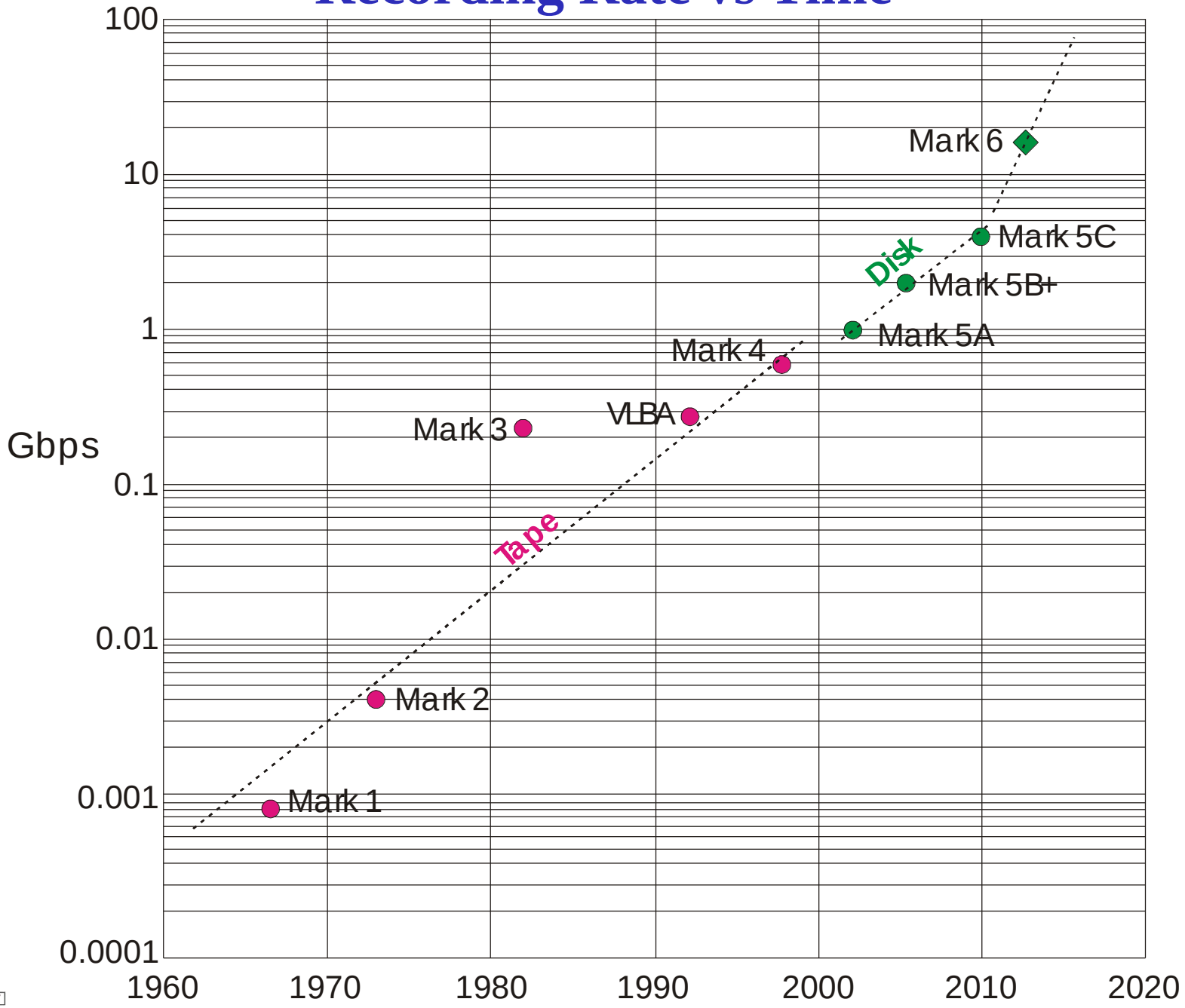
Additional Features

- Capture to ring buffers is kept separate from file writing (helps to facilitate e-VLBI)
- FIFO design decouples writing from capturing (e.g. keep writing during slew)
- Mk5b format packets are converted “on the fly” into vdif packets
- Playback is done by separate ‘gather’ program

Recording Rate vs Time



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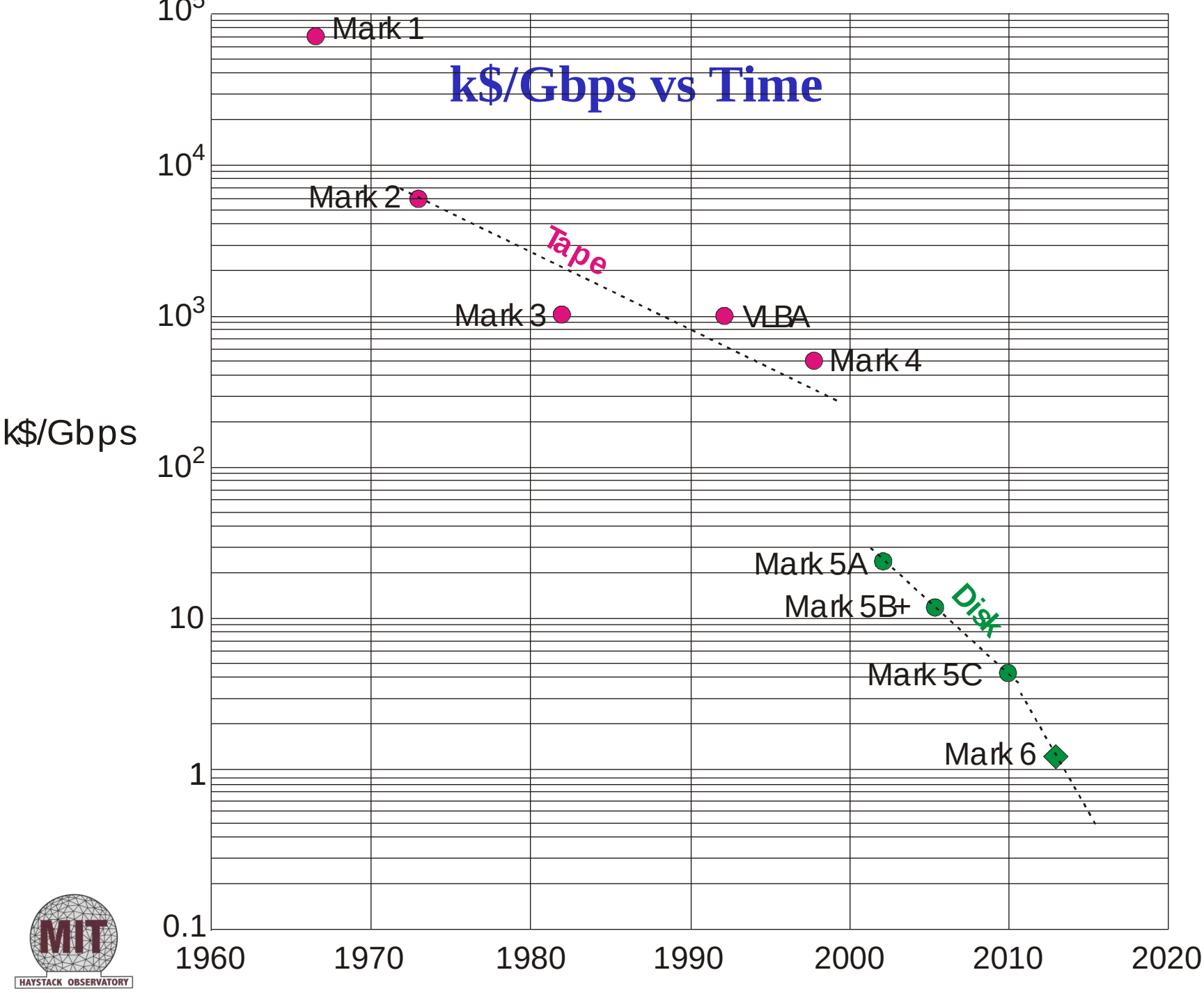

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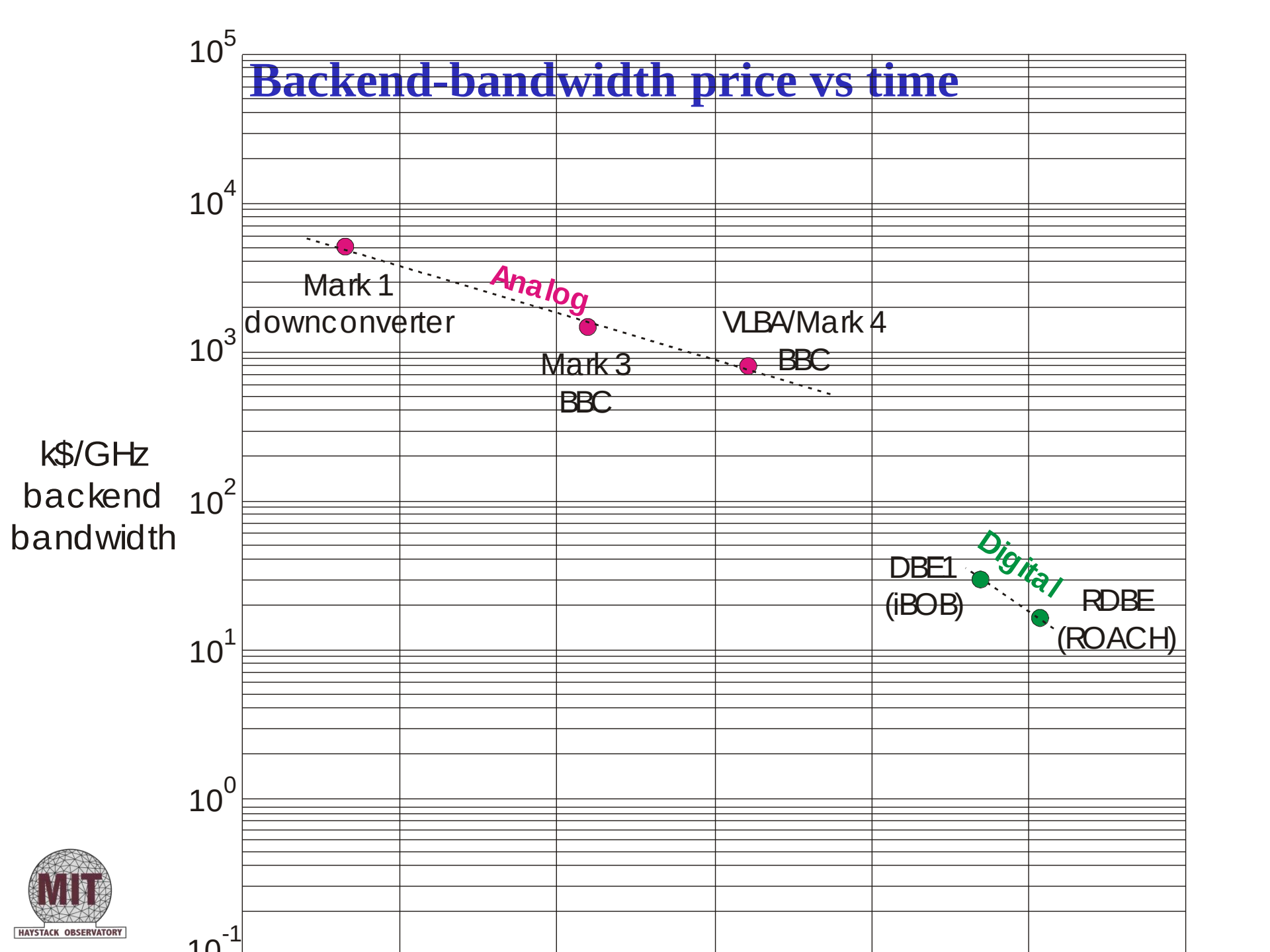
Backend-bandwidth price vs time
k$/GHz backend bandwidth
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
Mark 1 downconverter
Analog
Mark 3 BBC
VLBA/Mark 4 BBC
DBE1 (iBOB)
Digital
RDBE (ROACH)
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Questions?

Mark 6 16Gbps demonstration system